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TITLE: Apparatus for converting optical information into electrical information signal, information storage element and method for storing information in the information storage element

Abstract Paragraph Left (1):
An apparatus for converting optical information into an electrical information signal includes a plurality of one-dimensional conversion arrays arranged in parallel form. Each one-dimensional conversion array has first and second photoelectric conversion structures integrally formed. The first photoelectric conversion structure has photoelectric conversion elements each having a light receiving surface onto which an information light is projected. The second photoelectric conversion structure has photoelectric conversion elements each having a sweep light receiving surface onto which a sweep light is projected. The sweep light has a cross section which simultaneously scans the sweep light receiving surface of one of the photoelectric conversion elements included in each of the one-dimensional conversion arrays. The electrical information signal is read out from the photoelectric conversion elements provided in the first photoelectric conversion structure when the sweep light is projected onto the photoelectric conversion elements provided in the second photoelectric conversion structure.

Brief Summary Paragraph Right (1):
The present invention relates to an apparatus for converting optical information into electrical information signal and an information storage element. In addition, the present invention relates to a method for storing information in the information storage element.

Brief Summary Paragraph Right (2):
One type of apparatus for converting information applied as optical images, into electrical signals, was disclosed in Japanese Laid Open Patent Publication No. 62-139481 as an "Apparatus for converting optical image information into electrical signals". In this conversion apparatus, the optical image information is applied at a signal light receiving surface and is stored in a signal light photo-electrical conversion elements of a photo-electrical conversion portion for signal light.

Brief Summary Paragraph Right (4):
In this manner, the above described conversion apparatus is extremely effective for obtaining electrical signals corresponding to optical information which is stored in each of the areas where the sweep light is irradiated.

Brief Summary Paragraph Right (5):
In the case of a conventional apparatus for converting optical image information into electrical signals as described above, the scanning by the sweep light is performed either one dimensionally or two dimensionally. The information read is performed by the scanning of the sweep light and so the information read speed is determined by the scan speed of the sweep light. Accordingly, increasing the speed of the information conversion requires that the scan speed of the sweep light be increased but there is a limit to how fast the sweep speed can be made.

Brief Summary Paragraph Right (6):
In addition, in the above described prior art reference Japanese Laid Open Patent Publication No. 62-139481, the contents of the information that is held at each time by each of the signal light photo-electrical conversion elements in the photoelectric conversion portion for signal light is read as a continuous time series by the irradiating the sweep light to the sweep light receiving surface. Accordingly, the optical image information that is held as an entirety by the photoelectric conversion portion for signal light to which the signal light is irradiated is converted into an electrical signal time series accompanying the scan of the sweep light.

Brief Summary Paragraph Right (7):
The spatial positions in the photoelectric conversion portion for signal light for the optical image information correspond to the scan positions of the sweep light. The time axis of the time signal electrical signals obtained by the conversion of the optical information corresponds to the scan timing of the sweep light and is determined by the scan speed. Accordingly, if the scan speed of the sweep light is accurately determined, then the spatial positions of the sweep light and the positions on the time axis of the converted electrical signals have a relationship which is linearly proportional.

Brief Summary Paragraph Right (8):
However, in actuality, it is extremely difficult to scan the light beam accurately and at a predetermined speed. For example, one of the methods of scanning the light

beam at a constant speed is by light scanning by a polygonal mirror and an f.theta. lens. In such an optical system, variations in the rotational speed of the motor that rotates the polygonal mirror and aberrations and the like in the manufacture of the polygonal mirror, make it impossible practically, to scan at a constant speed.

Brief Summary Paragraph Right (9):
In the above described apparatus for converting optical image information into electrical signals, the read accuracy of the information lowers because the scan speed of the sweep light is not accurate when the optical image information is converted into electrical signals. For example, when the electrical signals obtained from the conversion are used as the basis for the information image, that reproduced image no longer accurately corresponds to the optical image information.

Brief Summary Paragraph Right (10):
Furthermore, the apparatus that converts the optical information into electrical signals is used as an information storage apparatus. The inventors of the invention of this application have proposed an information storage element of this type in Japanese Laid Open Patent Publication No. 62-34797.

Brief Summary Paragraph Right (12):
In addition, the prior art reference Japanese Laid Open Patent Publication No. 62-139481 discloses an apparatus for converting an optical image into electrical signals. According to the content of the technology disclosed in this prior art reference, the irradiation of the optical signals that include optical image information and their conversion into electrical signals are performed at the same time. This is to say that the information storage performance of the optical image information to electrical signal conversion element is not considered. However, this does no mean that there is no information storage performance for these elements as these optical image information to electrical signal conversion elements have a storage performance for extremely short time intervals in the msec order, for example. Accordingly, the optical image information to electrical signal conversion element can be used as a temporary memory. The optical image information to electrical signal conversion element can also be termed an information storage element. When the above described optical image information to electrical signal conversion element is thought of as an information storage element, there is a problem due to the presence of the above described electrical capacitance C.

Brief Summary Paragraph Right (14):
Accordingly, it is a general object of the present invention to provide a novel and useful apparatus for converting optical information into electrical information signal, an information storage element and a method for such, in which the problems described heretofore are eliminated.

Brief Summary Paragraph Right (15):
A more specific object of the present invention is to provide an apparatus for converting optical information into an electrical information signal, and which can efficiently convert optical information into an electrical information signal without having to increase the scan speed of the sweep light.

Brief Summary Paragraph Right (16):
This object of the present invention is achieved by an apparatus for converting optical information into an electrical information signal comprising a plurality of one-dimensional conversion arrays arranged in parallel form, each of the plurality of one-dimensional conversion arrays having a first photoelectric conversion structure and a second photoelectric conversion structure integrally formed with the first photoelectric conversion structure, the first photoelectric conversion structure having a plurality of photoelectric conversion elements which are actually arranged in a direction or configured so as to be substantially equivalent to an arrangement in which the plurality of photoelectric conversion elements are arranged in the direction, each of the plurality of photoelectric conversion elements have a light receiving surface onto which information light is projected, the second photoelectric conversion structure having a plurality of photoelectric conversion elements which are actually arranged in the direction or configured so as to be substantially equivalent to an arrangement in which the plurality of photoelectric conversion elements are arranged in the direction, each of the plurality of photoelectric conversion elements having a sweep light receiving surface onto which the sweep light is projected and each of the plurality of photoelectric conversion elements electrically coupled to a corresponding one of the plurality of photoelectric conversion elements of the first photoelectric conversion structure, and the sweep light having a cross section simultaneously scanning the sweep light receiving surface of one of said plurality of photoelectric conversion elements included in each of the plurality of one-dimensional conversion arrays, and the electrical information signal being read out from the plurality of photoelectric conversion elements provided in the first photoelectric conversion structure when the sweep light is projected onto the plurality of photoelectric conversion elements provided in the second photoelectric conversion structure.

Brief Summary Paragraph Right (17):
Another object of the present invention is to provide an apparatus for converting optical information into an electrical information signal, and which enables the accurate conversion of said optical image information into an electrical information signal.

Brief Summary Paragraph Right (18):
This object of the present invention is achieved by an apparatus for converting

optical information into an electrical information signal comprising a first photoelectric conversion structure having a plurality of photoelectric conversion elements which are actually arranged into a line or matrix or configured so as to be substantially equivalent to an arrangement in which the plurality of photoelectric conversion elements are arranged in a line or matrix, each of the plurality of photoelectric conversion elements having a light receiving surface onto which information light is projected, a second photoelectric conversion structure having a plurality of photoelectric conversion elements which are actually arranged into a line or matrix or configured so as to be substantially equivalent to an arrangement in which the plurality of photoelectric conversion elements are arranged into a line or matrix, each of said plurality of photoelectric conversion elements having a scanning sweep light receiving surface onto which the scanning sweep light is projected and each of the plurality of photoelectric conversion elements electrically coupled to a corresponding one of the plurality of photoelectric conversion elements of the first photoelectric conversion structure, and a third photoelectric conversion structure having a plurality of photoelectric conversion elements which are actually arranged into a line or matrix or configured so as to be substantially equivalent to an arrangement in which the plurality of photoelectric conversion elements are arranged into a line or matrix, each of said plurality of photoelectric conversion elements having a synchronizing sweep light receiving surface onto which the synchronizing sweep light is projected, the synchronizing sweep light being in synchronism with the scanning sweep light, an electrical synchronizing signal being generated by the third photoelectric conversion structure, the electrical information signal being read out from the plurality of photoelectric conversion elements provided in said first photoelectric conversion structure together with the electrical synchronizing signal when the sweep light is projected onto the plurality of photoelectric conversion elements provided in the second photoelectric conversion structure.

Brief Summary Paragraph Right (20):
This object of the present invention is achieved by an information storage element comprising a first semiconductor layer, a second semiconductor layer, one of the first and second semiconductor layers being a photoelectric conversion layer, the other being an information storage layer in which optical information irradiated onto the photoelectric conversion layer is converted into electrical information and stored therein, a first electrode formed on the first semiconductor layer, and a second electrode formed on the second semiconductor layer at a position excluding a position where the second electrode confronts the first electrode. A position excluding a position where a pair of electrodes is opposite to each other means not only a case where the electrodes are not opposite to each other at all but also a case where the electrodes are partially opposite to each other so that an electrical capacitance formed thereby is too small to affect response characteristics of the information storage element at the time of storing or reading information.

Brief Summary Paragraph Right (22):
This object of the present invention is achieved by a method of storing information in an information storage element including a first semiconductor layer, a second semiconductor layer, one of said first and second semiconductor layers being a photoelectric conversion layer, the other being an information storage layer in which optical information irradiated onto the photoelectric conversion layer is converted into electrical information and stored therein, a first electrode formed on the first semiconductor layer, and a second electrode formed on the second semiconductor layer at a position excluding a position where the second electrode confronts the first electrode, the method comprising the steps of scanning the photoelectric conversion layer by a light beam, and switching the polarity of a voltage to be applied across the first and second electrodes between a positive polarity and a negative polarity in accordance with binary information to be written into the information storage layer in a state where a light beam is being projected onto the photoelectric conversion element.

Drawing Description Paragraph Right (1):
FIGS. 1A and 1B are views indicating the structure of an apparatus for the conversion of optical image information into electrical information, and relating to a first embodiment according to the present invention.

Drawing Description Paragraph Right (3):
FIGS. 3A through 3C are views indicating the detailed structure of an apparatus for converting optical information into electrical signals, and relating to a first embodiment according to the present invention.

Drawing Description Paragraph Right (5):
FIG. 6 is a view indicating the structure of an apparatus for the conversion of optical image information into electrical information, and relating to a second embodiment according to the present invention.

Drawing Description Paragraph Right (11):
FIG. 12 is a view indicating an embodiment of an information storage element for converting optical image information storage element for converting optical image information into electrical signals, and according to the present invention.

Drawing Description Paragraph Right (12):
FIGS. 13 and 14 are views indicating another embodiment of an information storage element for converting optical image information into electrical signals, and according to the present invention.

Detailed Description Paragraph Right (1):
A description will be given of a first embodiment of a device for converting optical image information into electrical information according to the present invention with reference to FIGS. 1A through 3C. The device for converting optical image information into electrical information will be termed a converting device.

Detailed Description Paragraph Right (2):
In FIG. 1A, the converting device 10 has a surface (S.sub.1) and a surface (S.sub.2) opposite to the surface (S.sub.1). A signal light (I.sub.c) including optical image information irradiates the surface (S.sub.1) of the converting device 10. This signal light has two-dimensional expansion. The surface (S.sub.2) of the converting device 10 is scanned with a sweep light (I.sub.d) in the direction of an arrow shown in the figure. FIG. 1B is a view of the converting device 10 from the surface (S.sub.2) side. The converting device 10 has a plural number of one-dimensional photoelectric conversion arrays 10-1, 10-2, . . . , 10-n. These one-dimensional photoelectric convention arrays 10-1, 10-2, . . . , 10-n are mutually arranged in parallel and each pair of two adjacent one-dimensional photoelectric conversion arrays are close to each other.

Detailed Description Paragraph Right (7):
A laser beam emitted from a laser device 12 is supplied to an optical system 14. The optical system 14 has mirrors, lenses, a mechanism having a deflection function and the like. The optical system 14 also has a mechanism for converting the shape of the beam section to a shape which is long and narrow, as has been described above. The beam deflected by the optical system 14 irradiates from one end of the converting device 10 to another end as the sweep light (I.sub.d). Then the sweep light (I.sub.d) scans the converting device 10 with a constant speed.

Detailed Description Paragraph Right (8):
In each one-dimensional photoelectric conversion array 10-i (i=1, 2, . . . , or n), while the sweep light scans, the electrical information corresponding to the optical image information included in the signal light can be obtained as an output signal appearing between the common terminal (T.sub.0) and the terminal (T.sub.i). Thus, when the sweep light scans the surface (S.sub.2) of the converting device 10 only once, electrical signals corresponding to the optical image information for n-lines are obtained. If, once every scanning, for example, a document as a source of the optical image information, is moved n-lines in the perpendicular direction to the scanning direction, one-dimensional optical image information can be read every n-line.

Detailed Description Paragraph Right (18):
In FIG. 4, a converting device 20 has a plural number of one-dimensional photoelectric conversion arrays 20-1, 20-2, . . . , and 20-n. These one-dimensional photo-electric conversion arrays 20-1, 20-2, . . . , and 20-n are mutually arranged in parallel at a pitch of two times the width of a pixel. Each of the one-dimensional photoelectric conversion arrays 20-1, 20-2, . . . , and 20-n are electrically connected to the common terminal (T.sub.0) and to the terminal (T.sub.i) (i=1, 2, . . . , and n), in the same way as is shown in FIG. 1B. The sweep light (I.sub.d) irradiates and scans all the one-dimensional photoelectric arrays 20-1, 20-2, . . . , and 20-n at the same time. In this case, when the sweep light scans the converting device 20 only once, an area of an optical image for 2n lines is scans. Then, the optical image information is converted to an electrical signal for every second line. The sweep light scans the converting device 20 once, a document which is a source of the optical image information is moved one line in the perpendicular direction to the scanning direction and then the sweep light scans the converting device 20 once more. When two scannings are performed in this manner, the converting device 20 outputs electrical signals for 2n lines.

Detailed Description Paragraph Right (24):
According to the converting device as has been described above, when the sweep light scans the converting device once, sweep light scans the converting device once, the converting device is capable of converting the optical image information for a plural number of lines into the electrical signals. Thus, the converting device can efficiently convert the optical information into electrical signals without having to increase the scanning speed of the sweep light.

Detailed Description Paragraph Right (32):
The sweep light (I.sub.d) has a section having a shape which is long in the direction perpendicular to the scanning direction and narrow in the area having hatching in FIG. 6. The sweep light (I.sub.d) irradiates via substrate 16 the second photoelectric conversion element and the third photoelectric conversion element at the same time. That is, the sweep light (I.sub.d) also has a function as a sweep light for synchronization. A sweep light for synchronization. A signal light (I.sub.s) including one-dimensional optical image information is supplied to the converting device from the side of the transparent electrode 23. Then, the sweep light (I.sub.d) irradiates and scans the substrate 16. When this occurs, the sweep light (I.sub.d) irradiates the transparent areas and the shaded areas of the grating layer 70 and only through the transparent areas is the sweep light (I.sub.d) incident to the right-hand portion of the photoelectric conversion layer (i.e. the third photoelectric conversion element). Thus, a pulse signal corresponding to the arrangement of pixels is generated between the terminals (T.sub.1) and (T.sub.3). On the other hand, through the substrate 16 the sweep light (I.sub.d) is incident to the left-hand portion of the photoelectric conversion layer (i.e. the second photoelectric conversion element), while the sweep light (I.sub.d) is scanning. Thus, because of the scanning of the sweep light (I.sub.d), an electrical signal

corresponding to the one-dimensional optical image information appears between the terminals (T.sub.1) and (T.sub.2).

Detailed Description Paragraph Right (34):
In this manner, it is possible to correctly read the optical image information for every pixel and to convert the optical image information into an electrical signal.

Detailed Description Paragraph Right (47):
The structure where the stacked layer 21, 30 and 31 for converting the signal light into the electrical signal are divided into portions corresponding to pixels has been disclosed in the Japanese Laid Open Patent Publication No. 62-139481. The semiconductor layers 21 and 30 are electrically connected to each other. The sweep light (I.sub.d) in this embodiment also functions as the sweep light for synchronization. In the status where the signal light (I.sub.s) including the optical image information irradiates the transparent electrode 40, when the sweep light (I.sub.d) scans the surface of the transparent substrate 16 in the direction orthogonal to the drawing, the pulse signal is generated between the terminals (T.sub.1) and (T.sub.3) and an electrical signal appears between the terminals (T.sub.1) and (T.sub.2) at the same time. The shape of the pulse signal corresponds to the arrangement of the insulation members, as has been described above, in the semiconductor layer 21 on the left-hand portion of the semiconductor layer 20. That is, the shape of the pulse signal corresponds to the arrangement of the pixels. The clock signal is generated on the basis of the pulse signal and the electrical signal from the terminals (T.sub.1) and (T.sub.2) is sampled in synchronization with the clock signal so that the optical image information is properly read and an electrical signal accurately corresponds to every pixel.

Detailed Description Paragraph Right (48):
In the embodiments as has been described with reference to FIGS. 6, 7A, 7B and 8, one-dimensional optical image information is converted into an electrical signal. On the other hand, it is possible to provide a device having a structure where a plural number of the converting devices as is shown in FIGS. 6, 7A, 7B and 8 are closely arranged in parallel in the direction orthogonal to the direction of the scanning by the sweep light. In this case, when the signal light including two-dimensional optical image information irradiates the photoelectric conversion layers arranged in parallel for a signal light, and the sweep light two-dimensionally scans the photoelectric conversion layers for the sweep light and the photoelectric conversion layers for the sweep light for synchronization, it is possible to read the two-dimensional optical image information properly.

Detailed Description Paragraph Right (53):
In FIG. 9A, the left-hand portions of stacked layers 2T, 2 and 3 and the transparent electrode 31T form "an optical image reading element". The right-hand portions of stacked layers 2T, 2 and 3 and the transparent electrode 32T form the photoelectric conversion layer for the sweep light for synchronization.

Detailed Description Paragraph Right (54):
The signal light including the one-dimensional optical image information irradiates the transparent electrode 31T. A homogeneous light (I.sub.c) irradiates the transparent electrode 32T and is incident via the transparent electrode 32T on the photoelectric conversion layer 3 becomes active. Intensity of the homogeneous light (I.sub.c) is almost constant spatially and timewise. In the status where the signal light (I.sub.s) and the homogeneous light (I.sub.c) irradiate the converting device as has been described above, the sweep light irradiates and scans the converting device from the side of the transparent substrate 16. Then the sweep light (I.sub.d) is incident via the grating layer 70, the transparent substrate 16 and the transparent electrode 2T on the photoelectric conversion layer 2 as the sweep light for synchronization.

Detailed Description Paragraph Right (55):
While the sweep light (I.sub.d) scans the converting device, an electrical signal corresponding to optical image information appears between the electrodes 2T and 31T, and a pulse signal having a shape corresponding to the arrangement of the pixels is generated between the electrodes 2T and 32T. Then, a clock signal for synchronization is generated on the basis of the pulse signal, and an image signal is obtained with synchronization in the clock signal from the electrical signal which appears between the electrodes 2T and 31T.

Detailed Description Paragraph Right (64):
In FIG. 10A, for example, a light (I.sub.o) emitted from a light source is deflected in the direction orthogonal to the drawing by an optical system such as shown in FIG. 2. The deflected light (I.sub.o) is incident on a semitransparent mirror (M). Then, a part of the light (I.sub.o) is transmitted through the semitransparent mirror (M) and the remainder is reflected on the semitransparent mirror (M). The light which is transmitted through the semitransparent mirror (M) and scans the element (A) is the sweep light (I.sub.d1). The light which is reflected on the semitransparent mirror (M) and scans the element (B) is the sweep light (I.sub.d2) for synchronization. The signal light (I.sub.s) is also incident on a surface of the element (A) opposite to the surface where the sweep light scans.

Detailed Description Paragraph Right (65):
In FIG. 10B, the element (A) for reading the optical image and the element (B) for generating the pulse signal for synchronization are arranged in a line and connected to each other. A first light indicated by a solid line in FIG. 10B emitted from a first light source (not shown in FIG. 10B) is incident on a polygonal mirror (RM)

which is rotated. Then, the first light which is deflected in the direction orthogonal to the drawing by the polygonal mirror (RM) and scans the element (A) is the sweep light (I.sub.d1). On the other hand, a second light indicated by a dotted line in FIG. 10B emitted from a second light source (not shown in FIG. 10B) is also incident on the polygonal mirror (RM). Then the second light which is deflected in the direction orthogonal to the drawing by the polygonal mirror (RM) and scans the element (B) is the sweep light (I.sub.d2) for synchronization. The incident angle of the first light with respect to the polygonal mirror (RM) is determined so that the first light which is the sweep light (I.sub.d1) positively hits the element (A). The incident angle of the second light with respect to the polygonal mirror (RM) is determined so that the second light which is the sweep light (I.sub.d2) for synchronization positively hits the element (B).

Detailed Description Paragraph Right (66):
In FIG. 10C, the light (I.sub.o) from the optical system is separated into the two lights by the semitransparent mirror (M) in the same manner as the case shown in FIG. 10A. One light is the sweep light for synchronization and scans the element (B). The other light is incident on the mirror (RM) which is rotated on a surface of the drawing so that the other light scans the element (A.sub.1) for reading the optical image in the direction parallel to the drawing (subscan). Thus, the other light which scans the element (A.sub.1) two-dimensionally is the sweep light (I.sub.d1).

Detailed Description Paragraph Right (67):
In this case, the element (A.sub.1) has a structure in which the photoelectric conversion elements are two-dimensionally arranged. Thus, it is possible to read the two-dimensional optical image.

Detailed Description Paragraph Right (69):
The converting device 60 has an element (A) for reading the optical image and an element (B) for generating the pulse signal for synchronization. When the sweep light scans the element (A) and when the sweep light for synchronization scans the element (B), the element (A) outputs the electrical signal corresponding to the optical image information and the element (B) outputs the pulse signal having a shape corresponding to the arrangement of the pixels. The pulse signal from the element (B) inputs to a wave shaping circuit 61. The wave shaping circuit 61 shapes the pulse signal into a signal having a predetermined wave form. The output signal from the wave shaping circuit 61 inputs to a clock generation circuit 62. The clock generation circuit 62 generates a clock signal with synchronization in the pulse signal. Then, the clock signal from the clock generation circuit 62 inputs to an image information reading circuit 63. The image information reading circuit 63 samples the signal output from the element (A) with synchronization in the clock signal and outputs the sampled signal successively as image signal.

Detailed Description Paragraph Right (73):
The photoelectric conversion layer 130 is made of a photoelectric material such as amorphous silicon. The store and hold layer 140 has a stacked structure which is made up of insulating layers 141 and 142. For example, the insulating layer 141 is made of silicon dioxide (Si.sub.2 O) and is sufficiently thin so that a tunneling current flows, while the insulating layer 142 is made of silicon nitride (SiN) and has a thickness in the order of several hundreds of A.

Detailed Description Paragraph Right (80):
A portion of the photoelectric conversion layer 130 where no light L is irradiated has a high impedance. For this reason, an electricl capacitance between the electrodes 120 and 150 is small, and an electrical capacitance C of the element as a whole can be made small.

Detailed Description Paragraph Right (98):
The embodiments of the information storage elements shown in FIGS. 12 through 14 are one-dimensional. Hence, when making a store, read or erase operation on the information storage element, the optical image is irradiated one-dimensionally in the direction perpendicular to the paper in FIGS. 12 through 14 or a light beam scans the information storage element. But of course, a plurality of information storage elements may be arranged two-dimensionally in the horizontal direction in FIGS. 12 through 14 and make the information storage, reading or erasure by scanning the information storage elements by a light beam which makes a two-dimensional scan.

CLAIMS:

1. An apparatus for converting optical information into an electrical information signal, comprising:

a plurality of one-dimensional conversion arrays arranged in parallel form, each of said plurality of one-dimensional conversion arrays having a first photoelectric conversion structure and a second photoelectric conversion structure integrally formed with said first photoelectric conversion structure,

said first photoelectric conversion structure having a plurality of photoelectric conversion elements which are actually arranged in a direction or configured so as to be substantially equivalent to an arrangement in which said plurality of photoelectric conversion elements are arranged in said direction, each of said plurality of photoelectric conversion elements having a light receiving surface onto which information light is projected,

said second photoelectric conversion structure having a plurality of photoelectric conversion elements which are actually arranged in said direction or configured so as to be substantially equivalent to an arrangement in which said plurality of photoelectric conversion elements are arranged in said direction, each of said plurality of photoelectric conversion elements having a sweep light receiving surface onto which said sweep light is projected, and each of said plurality of photoelectric conversion elements electrically coupled to a corresponding one of said plurality of photoelectric conversion elements of said first photoelectric conversion structure, and

said sweep light having a cross section simultaneously scanning said sweep light receiving surface of one of said plurality of photoelectric conversion elements included in each of said plurality of one-dimensional conversion arrays, and said electrical information signal being read out from said plurality of photoelectric conversion elements provided in said first photoelectric conversion structure when said sweep light is projected onto said plurality of photoelectric conversion elements provided in said second photoelectric conversion structure.